

TITLE OF THE INVENTION

[0001] Medical Tubing Pump

BACKGROUND OF THE INVENTION

[0002] The invention relates to a medical tubing pump or flexible tube pump.

5 [0003] Such tubing pumps or tubing roller pumps are used in medical technology in order to supply and lead away various fluids to and/or from a patient. These pumps comprise a pump wheel on whose circumference cams or rollers are arranged. A pump tubing is wrapped around the pump wheel so that the tubing is squeezed in an orbital manner by way of the cams or rollers on rotating the pump wheel, whereby a fluid is transported further into the inside of the pump tubing. Such
10 tubing pumps are designed as open or closed tubing pumps.

[0004] In the closed design the pump wheel is arranged below a cover so that the pump wheel and the applied tubing are arranged inside a housing. With these pumps it is ensured that operation is only possible if the cover is closed, so that the danger of damage to the pump wheel is ruled out. However, the construction of these tubing pumps is more expensive, and the insertion of the pump
15 tubing is more complicated than with the openly designed tubing pumps.

[0005] In the open pumps the pump wheel is provided outside the housing, for example on the front plate of the pump housing. Furthermore, two tubing insertion locations in which the pump tubing is fixed are provided laterally of the pump wheel, such that the tubing is wrapped around the pump wheel over an angular range of essentially 180°. This arrangement has the particular
20 disadvantage that if the pump tubing has been incorrectly inserted, there exists a danger of injury to the extent that fingers may get caught or squeezed between the pump tubing and the pump wheel.

BRIEF SUMMARY OF THE INVENTION

[0006] It is an object of the invention to provide an improved medical tubing pump or medical flexible tube pump, which offers adequate protection from damage or injury, even with an open
25 design. A medical tubing pump achieves this object with a pump wheel having a circumference and a front side perpendicular to the wheel axis, two tubing insertion locations for insertion of a pump tubing such that the tubing wraps around the pump wheel, and a stationary protective ring for covering the inserted pump tubing, the protective ring surrounding the entire circumference of the pump wheel at the front side of the wheel.

30 [0007] The medical tubing pump according to the invention comprises a pump wheel and two tubing insertion locations into which a pump tubing or flexible pump tube may be applied in a

manner such that it is wrapped around the pump wheel. Here, the pump insertion locations are arranged in a known manner laterally of the pump, so that a pump tubing fixed in the tubing insertion locations may wrap around the pump wheel over an angular range of about 180°. The pump wheel in a known manner may comprise rollers or cams, which on rotation squeeze the tubing for conveying a fluid.

[0008] In the tubing pump according to the invention, a protective ring is provided for protection from injury. The ring surrounds the pump wheel along its entire circumference. Here, the protective ring is arranged essentially in the plane of the front side or outer side of the pump wheel. With a tubing pump designed in an open manner, a gap thus arises between the protective ring and the pump housing into which the pump tubing is inserted. The pump tubing is thereby covered to the outside by the protective ring, so that any catching or squeezing between the tubing and pump wheel may be prevented. The protective ring extends on the circumference of the pump wheel radially outwardly from the pump wheel and thus essentially forms a radial extension of the front surface of the pump wheel. At the same time, the protective ring is designed in a stationary manner, i.e. it does not rotate together with the pump wheel.

[0009] The protective ring is preferably rigidly attached to the pump housing. The protective ring covers the regions in which there exists the danger of snagging, namely the regions between the rotating pump wheel and the stationary pump tubing fixed in the tubing insertion locations. There exists no danger of pinching between the protective ring and the pump tubing since these are both stationary, so that no relative movement between the protective ring and the pump tubing takes place.

[0010] Preferably the protective ring directly borders on the pump wheel over its entire circumference without contact. This means that the gap between the stationary protective ring and the rotating pump wheel is designed as narrow as possible, so that any pinching between the pump wheel and the protective ring becomes impossible.

[0011] The protective ring preferably extends essentially flush to the front side of the pump wheel. This means that the surface of the protective ring lies in one plane with the surface of the outer side or front side of the pump wheel, so that an even front surface is created. The even design of the pump wheel and the protective ring prevents a snagging or jamming of objects on the moving pump wheel.

[0012] A front plate, which covers the front side of the pump wheel and extends radially outwardly beyond the circumference of the pump wheel, preferably forms the protective ring. Here, the front plate is arranged in front of the pump wheel, spaced from the front or outer end face of the

pump wheel, so that the pump wheel may rotate without contact below the front plate. The distance between the front plate and the end face of the pump wheel is kept as small as possible, so that it is not possible for the pump tubing to jam between the pump wheel and the front plate. The front plate extends radially beyond the circumference of the pump wheel, so that the front plate at least partially covers an inserted pump tubing.

[0013] Here, at least the region of the pump tubing in contact with the pump wheel is covered, so that the danger of a snagging of objects or body parts between the pump tubing and the pump wheel is prevented. This embodiment, where the protective ring, i.e., that part extending radially outwardly beyond the circumference of the pump wheel, is part of a continuous front plate, has the advantage that no components whatsoever lie open, so that a danger of injury is reduced. However, the lateral regions of the pump wheel below the front plate remain open, so that the pump tubing may be inserted without problem without any type of covering having to be opened

[0014] The protective ring and the tubing insertion locations preferably form a sub-assembly. This means that the tubing insertion locations together with the protective ring are made available as one component, which may, for example, be attached to the front plate of a pump housing. In this manner the number of required components may be reduced and the assembly simplified.

[0015] It is further preferred that the protective ring or front plate be formed as one piece with the tubing insertion locations, the one piece preferably being made of plastic. Such a component may, for example, be manufactured very inexpensively as an injection-molded part. Suitable recesses are formed in this one-piece component, which serve as tubing insertion locations. The component further comprises a circular through opening, whose surrounding material forms the protective ring. The pump wheel engages into the through opening when the protective ring is assembled.

[0016] The protective ring is preferably part of a cage surrounding the pump wheel. This cage surrounds the entire circumferential region of the pump wheel and thus serves as a protection from injuries, for example on account of snagging on the moving parts, i.e., the pump wheel.

[0017] The cage preferably comprises a rear ring, which circumferentially surrounds the pump wheel and bears on a front plate of a pump housing. The rear ring is spaced from the protective ring by an amount equal to or larger than the diameter of the pump tubing to be accommodated. This arrangement permits the pump tubing to be inserted between the protective ring and the rear ring, so that the tubing may be fixed or positioned by these two rings. Furthermore, by way of the protective ring and the rear ring, the gap arising between the pump tubing and the rotating pump wheel is covered, so that a snagging between the moving and stationary parts is not possible in this region.

[0018] Preferably, a gap, which is continuous in the radial direction, is formed between the protective ring and the rear ring in a circumferential section designed for accommodating a pump tubing. This means that, in the region where the pump tubing is wrapped around the pump wheel, the space between the protective ring and the rear ring and facing the pump wheel, is formed in an open manner, so that the pump tubing in this region may come into contact with the rollers or cams on the pump wheel. In this region no connections whatsoever are provided between the protective ring and the rear ring, so that the pump wheel may come into contact with the pump tubing over this entire circumferential section. Furthermore, the gap between the protective ring and the rear ring, in which gap the pump tubing is inserted, is designed to be open over the circumferential region between the pump insertion locations of the cage, so that the pump tubing may be inserted easily from the outside without components having to be opened or removed.

[0019] The protective ring and the rear ring of the cage are usefully connected to one another in the region of the tubing insertion locations. In this manner a one-part, preferably a one-piece component consisting of the protective ring, the rear ring and the tubing insertion locations, is created. This one-part component may be easily attached to a pump housing, in particular the front plate of a pump housing. In the region of the tubing insertion locations the protective ring and the rear ring may be connected to one another without the insertion of the pump tubing being hindered. In this manner, in the remaining circumferential region where the pump tubing is to wrap around the pump wheel, a gap may be formed which is continuous in the radial direction and which is open to the outside for accommodating the pump tubing.

[0020] According to a particular embodiment, at least one tubing insertion location comprises a receiver for a sensor system. Thus, in the region of at least one tubing insertion location an enlarged receiver or recess may be formed into which a pressure chamber of a pressure sensor may be applied. Here, the pressure chamber is preferably fixed in the recess with a non-positive or positive fit by way of clamping or locking. This permits a simple assembly and fixation of the pressure chamber or a sensor system.

[0021] The protective ring preferably has a radial extension which corresponds at least to the diameter of the pump tubing. In this way, it is ensured that the pump tubing is largely covered by the protective ring. In particular, the gap arising between the stationary pump tubing and the rotating pump wheel is completely covered by the protective ring, so that there is no longer any danger of injury in this region.

[0022] The above described arrangement of a protective ring permits an improved guiding and fixation of the pump tubing on the pump wheel. At the same time, the protective ring covers the

regions in which there exists an increased danger of injury, so that a safe operation of the tubing pump according to the invention is possible.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0023] The foregoing summary, as well as the following detailed description of the invention, will be better understood when read in conjunction with the appended drawings. For the purpose of illustrating the invention, there are shown in the drawings embodiments which are presently preferred. It should be understood, however, that the invention is not limited to the precise arrangements and instrumentalities shown. In the drawings:

[0024] Fig. 1 is a schematic front perspective view of the front plate of a pump housing having a protective ring according to the invention;

[0025] Fig. 2 is a front side perspective view of a protective cage according to one embodiment of the invention; and

[0026] Fig. 3 is a front side perspective view of a protective cage according to a second embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0027] Fig. 1 shows a schematic perspective view of the front plate 2 of a pump housing. A drive unit 4 is arranged on the rear side of the front plate 2, i.e. inside the pump housing (not shown here). The drive unit 4 comprises, for example, an electric motor with associated gear means. The pump wheel 6 is arranged on the front side of the front plate 2. The pump wheel 6 is driven in rotation by the drive unit 4. Individual rollers 8 are arranged at the circumference of the pump wheel 6, which in the present case is designed as a roller wheel. On rotation of the pump wheel 6, the rollers 8 run in a known manner over an inserted pump tubing (not shown here) and thus create a pumping effect in the tubing.

[0028] According to one embodiment of the invention, the pump wheel 6 is surrounded by a protective cage 10. The protective cage 10 at its front side, i.e. at its side facing away from the front plate 2, comprises a protective ring 12, which circumferentially surrounds the pump wheel at its front or end face. Here, the front surface of the cage 10 and of the protective ring 12 essentially forms a plane with the front surface of the pump wheel 6. The circumferential gap 14 between the pump wheel 6 and the protective ring 12 is formed as narrowly as possible, so that no objects or body parts may snag or catch in the gap 14 between the rotatable pump wheel 6 and the stationary protective ring 12.

[0029] The cage 10 further comprises a rear ring 16, which circumferentially surrounds the pump wheel 6 at its side facing the front plate. The protective ring 12 and the rear ring 16 are arranged spaced from one another in a direction normal to the front plate 2, so that a gap 18 is formed between the protective ring 12 and the rear ring 16. The gap 18 is formed to be open at the circumference of the pump wheel 6, so that pump tubing (not shown here) may be inserted from the outside. Here, the gap 18 is formed as a radially continuous opening over a circumferential region of 180°, in which pump tubing may be wrapped around the pump wheel 6. This means that in this region no connection whatsoever is provided between the rear ring 16 and the protective ring 12, so that in this region pump tubing may come into contact with the pump wheel 6 over the complete circumferential section thereof. Furthermore, the gap 18, proceeding from the region of the tubing wrap on the circumference of the pump wheel, extends tangentially up to the tubing insertion locations 20 and 22.

[0030] The tubing insertion locations 20 and 22 are designed as receivers or recesses as a single piece in the cage 10. The tubing insertion location 20 is designed as a receiver for a sensor system, for example in the form of a pressure chamber. The tube insertion location 20 is open at the front, i.e. on the front side of the cage 10, whereby this opening is in connection with the gap 18, so that the cage is open on the entire circumference of the pump wheel 6 for accommodating a pump tubing.

[0031] With the cage 10 according to the invention, the insertion of the pump tubing (not shown in the Figures) into the tubing pump is effected in a manner such that the pump tubing with its pressure chamber is inserted from the front into the first tubing insertion location 20, i.e. in a direction normal to the front plate 2, whereby the tubing with its pressure chamber is fixed in the tubing insertion location 20 with a non-positive or positive fit. Projections are formed in the tubing insertion location behind which the pressure chamber connected to the tubing engages, so that a force transmission in the longitudinal direction of the pump tubing is possible. The pump tubing is subsequently pushed further into the gap 18 and fixed at the second tubing insertion location 22. For this purpose, a suitable fastening element is formed on the pump tubing, and this element engages into the tubing insertion location 22, so that the pump tubing is fixed between the tubing insertion locations 20 and 22 under tension, in a manner such that it wraps around the pump wheel 6 in the gap 18.

[0032] The region between the stationary pump tubing and the rotating pump wheel 6, which entails a high risk of injury, is covered in a protective manner by the protective ring 12. The rear ring 16 covers the region between the front plate 2 and the pump tubing so that the danger of injury

is minimized at this location too. The protective ring 12 and the rear ring 16 simultaneously serve for guiding the pump tubing which wraps around the pump wheel 6, so that any incorrect insertion of the pump tubing and the danger of damage or injury which this entails are ruled out to a great extent. As a entire then, a safe operation of a tubing pump designed in an open manner is ensured by way of the cage 10.

[0033] Figure 2 shows a perspective detailed view of the cage 10. Proceeding from the region of the cage 10 in which the tubing insertion locations or tubing position locations 20 and 22 are formed, the protective ring 12 and the rear ring 16 extend parallel to and spaced from one another. The protective ring 12 and the rear ring 16 enclose a recess in the form of a circular through hole 24, which is designed for accommodating the pump wheel 6. The continuous gap 18, which is open to the hole 24 and to the outside, runs between the rear ring 16 and the protective ring 12. The opening of gap 18 to the outside extends into the tubing insertion location 22.

[0034] The tubing insertion location 20 comprises a groove, which is open toward the front surface and is connected to the gap 18. The outwardly directed openings of the groove of the tubing insertion location 20 and of the gap 18 are thus arranged offset by 90° to one another. The continuous opening of the gap 18 permits a simple insertion of a pump tubing from the circumferential side of the pump wheel 6 without any type of element having to be opened or removed. The cage 10 shown in Fig. 2 is, as shown in Fig. 1, fixedly connected, i.e., in a rotationally fixed manner, to the front plate 2, so that the cage 10 rigidly holds an inserted pump tubing on the front plate 2 while the pump wheel 6 rotates relative to the inserted pump tubing.

[0035] Fig. 3 shows a perspective detailed view of the cage 10 according to a second embodiment of the invention. Unlike the embodiment shown in Fig. 2 according to the second embodiment the front side of cage 10 is completely closed, so that the pump wheel 6 is completely covered by the front side of cage 10.

[0036] It will be appreciated by those skilled in the art that changes could be made to the embodiments described above without departing from the broad inventive concept thereof. It is understood, therefore, that this invention is not limited to the particular embodiments disclosed, but it is intended to cover modifications within the spirit and scope of the present invention as defined by the appended claims.